Virus Status of the Texas Grape Industry

2017 Advanced GRAPE GROWER Workshop
Hill Country University Center, Fredericksburg
June 19-20 2017
Sheila McBride Program Extension Specialist
Texas Plant Disease Diagnostic Lab
Virus Biology

- Obligate parasites - must have living host to replicate, cannot be cultured/grown in the classic way such as on growth media,
- Reproduce only inside infected cells,
- Depend on the aid of vectors (insects, nematodes, humans), propagation or the environment for their dissemination (spread).
Viruses infecting Grapevine

- Grapes are hosts to >70 infectious agents globally
- 15 families, 26 genera, several unassigned species
Major Virus Diseases

Leafroll

Fanleaf

Rugose Wood

Photo: Debra Golino
Major Virus Diseases

- Redblotch disease is becoming an emerging threat to the sustainability of the US grape industry
Grapevine Leafroll Disease (GLD)

- Most widespread
- Associated with several distinct closteroviruses
- Most GLRaVs belong to genus *Ampelovirus*
- *Grapevine leafroll-associated virus 3 (GLRaV-3)* is predominant
GLD Symptoms: Discoloration

- Cabernet Franc
- Chardonnay

Photo: Rayapati Lab
GLD Symptoms: Leaf Rolling

[Images of leaf rolling in Merlot and Chardonnay with text: Photo: Rayapati Lab]
‘Leafroll-like’ Symptoms

P deficiency

GLD

Mechanical Injury
Transmission of GLRaVs

- And understanding of virus vector life cycle useful for disease management
Detection of GLRaVs

Serological assays (ELISA)

Molecular assays (RT-PCR)
GLD Spread Within Vineyard

GLD incidence = 20%

Photo: M. Al Rwahnih
GLD Spread Within Vineyard

GLD incidence 5 years later = >60%

Photo: M. Al Rwahnih
Negative Impacts of GLD

- Reduced fruit load
- Delayed and uneven ripening
- Reduced sugar
- Increased acidity
- Dependent on variety, clone, rootstock, site, season, leafroll type and strain
- Mixed infections of multiple viruses often results in enhanced negative impacts

‘Healthy’

GLD+

Photo: M. Al Rwahnih
Fanleaf (GVFL)

- Caused by several nepoviruses
- Possess RNA genomes
- Vegetatively transmitted
- Field spread mainly by vectors: longidorid (needle) nematodes
- Associated with fruit yield losses and vine decline
Grapevine Redblotch Disease
GRBaV is widespread in the US

Source: M. Al Rwahnih
Grapevine redblotch-associated virus

- Posses a circular ssDNA genome
- Three-cornered Alfalfa Hopper, *Spissistilus festinus*, identified recently as a vector
  - Other vectors currently being investigated
GLD-like Impacts of Redblotch

Source: Poojari et al., 2013
Virus Survey in Texas Vineyards

- Sample collection
  - Growers and Viticulture Specialists
- Sample preparation, ELISA and/or RT-PCR
- Gel electrophoresis
Blanc du Bois
(GLRaV-3+)

Photo credit: Fran Pontasch
Redblotch Symptoms

Photo credit: Fran Pontasch
Viruses detected 2016

- Based on analysis of 115 samples

% incidence

- GLRaV-1
- GLRaV-3
- GLRaV-4
- TRSV
- GRSPaV
- GRBaV

Texas A&M AgriLife Extension
Predominance of Mixed Infections

Single virus (27.8%)

Negative (14.8%)

Mixed infection (55.7%)

Not tested (1.7%)

5 viruses

4 viruses

3 viruses

2 viruses
GLRaV-3

Austin, Hildalgo, Gillespie, Terry, McClennan, Hockley, Walker

GRBaV

Austin, Hildalgo, Gillespie, Terry, Harris, Victoria, Lynn, Walker
Additional Findings - 2016

- First Report of *Tobacco ringspot virus* Infecting an American Hybrid Grape Cultivar in Texas
  June 2017, Volume 101, Number 6 Page 1062
  https://doi.org/10.1094/PDIS-01-17-0111-PDN

- Nepovirus- Transmitted by a nematode
  - *Xiphinema americanus* (Dagger)
Soil samples collected from the TRSV positive vines
- *Xiphinema sp.* detected,
- PCR pending for detection of virus from nematodes collected.

50 Samples submitted
- ELISA results for GVLRa-3 and GVFL
  - GVLRa-3 $\rightarrow$ 7 positives found in 3 Blanc du Bois, 1 Victoria Red, 1 Black Spanish, 1 Sangiovese, and 1 wild mustango.
  - GVFL $\rightarrow$ All samples negative.
- PCR results pending for Grapevine leafroll-associated virus 1, Grapevine leafroll-associated virus 2, 3, 4, Tobacco ringspot virus, Grapevine fanleaf virus, Grapevine virus A and B, Grapevine rupestris stem pitting-associated virus, Grapevine red blotch-associated virus.
Managing Grape Virus Diseases

- Propagate clean nursery stocks
  - Buy only from certified nurseries
- Practice area-wide vector management
  - Use IPM tactics: insecticides, parasitoids, mating disruption
- Manage virus alternative hosts
  - Free-living grapes in riparian habitats
- Overall goal is to ‘Start Clean’ and ‘Stay Clean’
Virus disease management will be critical to maintaining a productive vineyard.
Guide for Recognizing and Collecting Samples to Test for Grapevine Viruses

By Olufemi Alabi and Sheila McBride
Texas A&M University Department of Plant Pathology and Microbiology

Viruses infecting grapevines have been recognized globally as major threats to the productivity of vineyards. Among them, grapevine leafroll-associated viruses (GLRaVs) and grapevine fanleaf virus (GFLV) are widespread and have been linked to decline in vine productivity and wine quality. Vine to vine transmission of GLRaVs and GFLV occur via insect and nematode vectors, respectively. A timely identification of infected vines enables implementation of measures to mitigate their spread within and between vineyard blocks. Symptoms caused by leafroll and fanleaf (Fig. 1) viruses may mimic symptoms of other disorders. Also, pre-symptomatic infections may occur. Therefore, clinical lab assays are needed to diagnose suspect vines. These viruses inhabit the phloem tissues of the grapevine and are unevenly distributed within the vine, making it further difficult to diagnose. These impediments can be overcome via collection of good tissue samples at time periods optimal for virus detection.

If your vines show any of the symptoms below, you should have them tested. The optimal time for virus disease symptoms expression in grapevines is post-véraison (onset of berry ripening). However, sampling can occur on vines any time of the year and there may even be value to sampling non-typical or asymptomatic vines. Dormant vines may be sampled by removing cane pieces in a manner similar to collecting leaves.
Sending samples to TPDDL
Proper sampling can ensure a proper diagnosis

- Representation of transition area between symptoms being observed.
- Entire plant if possible, if not foliar symptoms and subsample of root tissue.
  - Fresh and kept fresh.
- Complete information (completed form)
  - Note dates/times (when did symptoms begin to appear?).
  - Description of chemical management practices in the past 4 weeks.
- Photographs helpful when putting the pieces of the puzzle together.
The TX Plant Clinic

The Texas Plant Disease Diagnostic Laboratory, located in College Station, Texas, is a service lab of the Department of Plant Pathology and Microbiology at Texas A&M University in conjunction with Texas A&M AgriLife Extension Service.

*****IMPORTANT NOTICE*****

We are undergoing many changes and updates!! Such as, updated Routine Diagnostic & Nematode forms!!! Please be sure when submitting a sample to the clinic you are using the newest version of our forms. They will have the revision date of 6/17 in the top right corner. Also, changes are being made to our website, so continue to browse our website for the most up to date information!!

Customer sample inquiry (phone) support is available from 9:00am - 12:00 noon and 1:00pm – 4:00pm, Monday to Friday when the TX Plant Clinic is open.

For assistance with plant health issues, please contact your local Texas A&M AgriLife Extension county office. If contacting us, please email to get a quicker response. Our email contact is plantclinic@tamu.edu. Thank you for your patience.

Check out articles from our BLOG. The latest blog post is featured below. These are occasional articles of interest that are put together to share some happening in the Texas Plant Disease Diagnostic Lab. And LIKE US on our Facebook Page.

Rapid Decline of Oaks

FORMS / INSTRUCTIONS

D178 – General Diagnostic Form and Instructions

D827 – Nematode Detection Assay and Instructions

Other Submission Forms and Instructions: Citrus Greening, Pierce’s Disease, etc.

BLOG

Rapid Decline of Oaks
New treatment for the management of Cotton Root Rot
Plant Disease Diagnosis Form

Submitter contact information (Please print.)
Name: 
Company name (if commercial): 
Address: 
City: State/Zip: 
County: 
Phone: 
Email: 
Submitter is: [ ] Agrilife personnel [ ] Homeowner [ ] Consultant
[ ] Golf course [ ] Commercial [ ] Other
Send results via: [ ] Email [ ] Standard mail [ ] Send results to: [ ] Submitter [ ] Grower [ ] Third party

Grower contact/sample location information (Complete if different from submitter.)
Name: 
Company name (if commercial): 
Address: 
City: State/Zip: 
County: 
Phone: 
Email: 
Submitter is: [ ] Agrilife personnel [ ] Homeowner [ ] Consultant
[ ] Golf course [ ] Commercial [ ] Other
Send results via: [ ] Email [ ] Standard mail [ ] Send results to: [ ] Submitter [ ] Grower [ ] Third party

Complete form for diagnostic services. PRINT and mark [ ] all that apply.
Plant: __________ Variety/ cultivar: __________ Planting date: __________
Date first noticed: __________ Problem developed: [ ] Suddenly [ ] Gradually
Watering practices: [ ] Sprinklers [ ] Hand water [ ] Drip system [ ] None
[ ] Less than 3 times/week [ ] More than 3 times/week [ ] Variable as needed [ ] Daily
Pesticide/chemical application in last 3 weeks? [ ] Yes [ ] No Product applied? [ ] Yes [ ] No
Have you consulted other labs? [ ] Yes [ ] No If yes, what was concluded? __________
Have you contacted an Agrilife Extension Agent about this problem? [ ] Yes [ ] No
Would you like for us to send a copy of your results to your County Extension Agent? [ ] Yes [ ] No
Comments: __________

As of January 01, 2017: Routine diagnostic charge is $35 per specimen. This includes triage, microscopy, culturing and other basic tests as necessary, diagnostic report, and management suggestions. All out-of-state samples will be assessed a $20 surcharge/sample. Refer to the back of this form to view sampling and mailing instructions and/or make additional comments regarding the specimen.

If requesting a specific test, please select from the following (see http://plantclinic.tamu.edu/services for test details):

<table>
<thead>
<tr>
<th>Covered under our $35 routine diagnostic charge:</th>
<th>Tests that will be assessed an additional $20 each:</th>
<th>Tests that will be assessed an additional $30 each:</th>
</tr>
</thead>
<tbody>
<tr>
<td>[ ] Oak Wilt</td>
<td>[ ] Bacterial Leaf Scorch (Xylella sp. - ELISA)</td>
<td>[ ] Bacterial Leaf Scorch (Xylella sp. - PCR)</td>
</tr>
<tr>
<td>[ ] Dutch Elm Disease (DED)</td>
<td>[ ] Phytophthora sp. Root Rot</td>
<td>[ ] Palm Phytoplasma Disease (lethal Decline/ Lethal Yellowing)</td>
</tr>
<tr>
<td>[ ] Cotton Root Rot</td>
<td>[ ] Bacterial Leaf Spot (Xanthomonas sp.)</td>
<td>[ ] Ornamental Phytoplasma</td>
</tr>
<tr>
<td>[ ] Turfgrass Diseases</td>
<td>[ ] Virus</td>
<td>[ ] Palm Fusarium</td>
</tr>
<tr>
<td>[ ] Plant Pathogenic Bacterial Identification</td>
<td>[ ] Rose Rosette</td>
<td></td>
</tr>
</tbody>
</table>

Send bill to: [ ] Submitter [ ] Grower [ ] Third party
Act/PO Ref: __________
Make checks payable to Texas Agrilife Extension Service.
I agree to pay a minimum of $35 for this service; fees may be greater, based on services performed. I understand that accurate disease identification, diagnosis, and management recommendations are dependent on submission of appropriate specimens with thorough background information. Incomplete information and/or poor samples may lead to inaccurate diagnosis.

Signature: __________ Printed name: __________ Date: __________
Thanks to the Senate Bill 881

Questions?